heliocentric longitude is 30° on the earlier occasion and 225° on the later. The earth reaches these heliocentric longitudes in October and May respectively.

At the return of 1835 perihelion passage was on November 16. There was consequently a close approach between the earth and the comet about a month earlier. In 1910 the perihelion passage will be on April 20; a month earlier than this, when the comet is close to the earth's orbit, the earth will be at the diametrically opposite point. A month after perihelion, however, there will be a very close approach.

The most unfortunate date for perihelion passage for yielding a close approach to the earth is January. The comet would then be behind the sun at perihelion, and more than an astronomical unit away when crossing the earth's orbit.

On the present return the approach after perihelion will be unusually close. The following table gives the ecliptic coordinates of the earth for the annexed dates:—

Date		x		y
1910, May 10	...	$-0{\cdot}65$	...	$-0{\cdot}76$
,, 14	...	$-0{\cdot}60$	...	$-0{\cdot}80$
,, 18	...	$-0{\cdot}55$	...	$-0{\cdot}84$
,, 22	...	$-0{\cdot}49$	...	$-0{\cdot}87$
,, 26	...	$-0{\cdot}43$	...	$-0{\cdot}90$
,, 30	...	$-0{\cdot}37$	...	$-0{\cdot}93$

When, therefore, the comet crosses the plane of the ecliptic twenty-eight days after perihelion passage (May 18) it will be almost exactly between the earth and the sun, and the earth will probably be in the tail of the comet.

The closest approach at this return takes place a day or two later.

The closest approach possible would correspond to a perihelion passage about a week and a half earlier in the year than the present one.

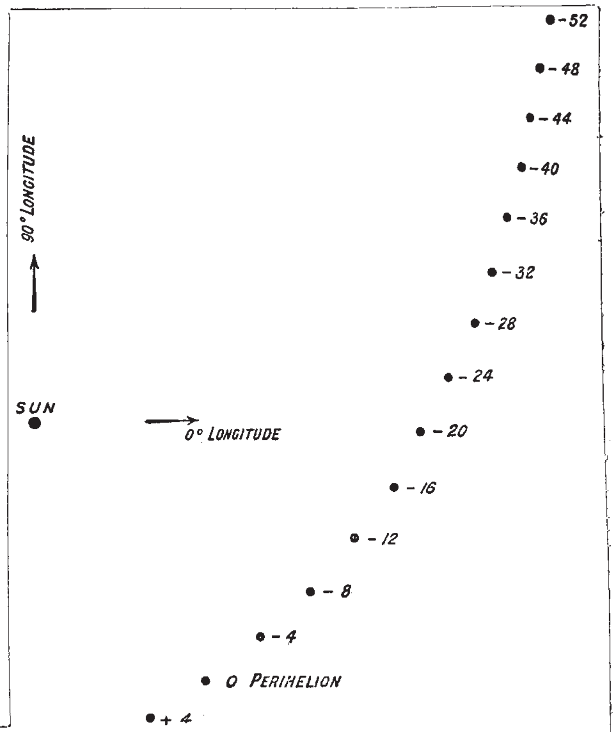
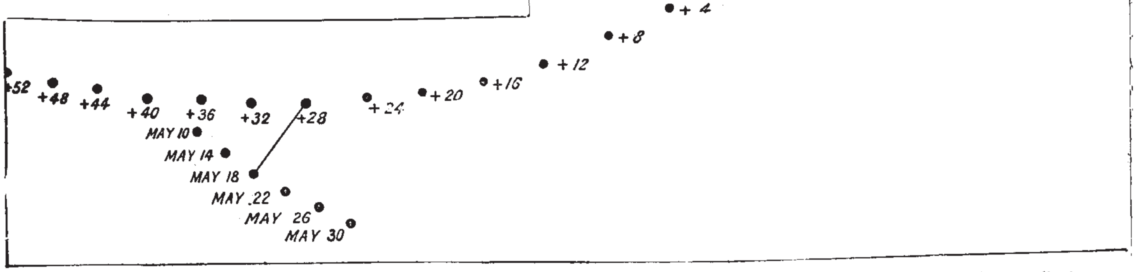
It appears, therefore, that the date of perihelion passage at this return is most fortunately timed, and a fine display may be expected.

The comet's history has been traced back to 240 B.C., and it has very seldom returned to perihelion unrecorded; so seldom, in fact, as to suggest that in the exceptional cases the records have perished rather than that the comet in any circumstances can pass by unseen.

A tail twenty or thirty degrees in length is expected on the present occasion. It will be best seen at the end of May, and in England it will, unfortunately, be lower in the sky than in more southern latitudes. There will, however, be no difficulty whatever in seeing it in England, unless there is a prolonged spell of bad weather.

The approach to the earth is so close that an American astronomer has conceived the idea of weighing the comet by the deviation it produces in the orbit of the earth. We can hardly believe that the effect produced will be one-thousandth part of the least measurable quantity, but the speculation is most interesting in view of the fact that there are unexplained phenomena in planetary movements.

P. H. COWELL.

The diagram gives the position of the Earth for six days in May; also the position of the comet on twenty-seven dates measured from perihelion passage in days. The line of sight is drawn for May 18, twenty-eight days after perihelion, when the comet transits across the Sun.

JUBILEE OF THE THEORY OF ELECTROLYTIC DISSOCIATION.[1]

IN his address to the British Association in 1884, the president, Lord Rayleigh, said, "from the further study of electrolysis we may expect to gain improved views as to the nature of chemical reactions, and of the forces concerned in bringing them about. . . . I cannot help thinking that the next great advance, of which we have already seen some foreshadowing, will come on this side."

The first step of the advance spoken of by Lord Rayleigh had already been made, for in that same year the young Swedish physicist, Arrhenius, presented as his doctor's dissertation to the University of Upsala a memoir with the title "Recherches sur la Conductibilité galvanique des Électrolytes. Première Partie: La Conductibilité des Solutions aqueuses ex-

[1] *Zeitschrift für physikalische Chemie.* Bd. 69, Jubelband. Svante Arrhenius zur Feier des 25-jährigen Bestandes seiner Theorie der elektrolytischen Dissociation gewidmet von seinen Freunden und Schülern. Mit einer Einleitung von W. Ostwald. Pp. xxix+685. (Leipzig: W. Engelmann, 1909.)

trêmement diluées," which was published in the "Bihang till Kongl. Vetenskapsakademiens Handlingar," vol. viii., and was followed in the same year by the second part, entitled "Théorie chimique des Électrolytes." These researches contain the germ of the theory of electrolytic dissociation, which, however, only received its complete statement in 1887, in the first volume of the newly founded *Zeitschrift für physikalische Chemie*.

The impression made on the university authorities by Arrhenius's thesis was not favourable. In their view, apparently, it was neither very good chemistry nor very good physics, and only deserved the mild commendation "non sine laude approbatur." Indeed, the fundamental conceptions of the new theory were so much at variance with the current ideas of both physicists and chemists that it can scarcely excite wonder to find that a strenuous opposition was offered to the introduction of the notion of free ions into science. Had it not been for the warm advocacy of Ostwald, who was already a power in the domain of physical chemistry, it is not at all unlikely that the theory would have remained in abeyance (as did Avogadro's hypothesis for nearly fifty years) until the necessity for it became imperative.

Happily, however, for the progress of science, the appearance of the theory synchronised with that of van 't Hoff's theory of osmotic pressure, which it supplemented by accounting for the apparent abnormalities displayed by electrolytic solutions. Armed with these two powerful weapons, Ostwald, by his writings, by his researches, and not least by his establishment of a school of physical chemistry in Leipzig, where, under his stimulus, the theories were practically applied by his pupils to the elucidation of numerous problems in the physics and chemistry of solutions, gradually overcame effective opposition, and secured a permanent, if somewhat reluctant, recognition of the new ideas. To this period belongs the fundamental application of the two theories by Nernst to the calculation of electromotive forces. The only parallel in physical chemistry to the activity and fertility of those days is to be found in the contemporary development of radio-active research.

We occasionally hear it said at the present time that the theory of electrolytic dissociation is "played out," that it was useful for a season, but that it must now be superseded by something different and better. Not many years ago, similar statements were made regarding the kinetic theory of gases—that it had served its purpose, was very good so far as it went, and might be peacefully left to die a natural death. To-day the kinetic theory is far from moribund, and it seems to the present writer that a corresponding vitality is inherent in the theory of Arrhenius. Wide-reaching and fruitful physical theories generally contain a well-defined notion which survives any change of form which the theory or its mechanical interpretation may undergo. Dalton's atomic theory contains the imperishable notion of fixed combining weights for the elements; Avogadro's theory contains the definition of molecular weight; and from these two together we obtain, as Cannizzaro showed, the modern atomic weight. Whether we believe in atoms and molecules or not, these conceptions of combining, atomic and molecular weights will persist unaltered, and survive any upheaval in chemical theory. Similarly, Arrhenius's great positive contribution to physico-chemical science is the notion and practical definition of degree of ionisation. Whatever be our views of the origin and nature of ions, we must, in any quantitative investigation of the properties of electrolytic solutions, have recourse to the notion of degree of ionisation.

Arrhenius has since been active in many fields besides that of physical chemistry, notably in cosmic physics and in serum-therapy, bringing to bear in these branches of science the same clear-headedness and sublimated common-sense which enable him in the multiplicity of the details he so easily masters to detect the simple principles which coordinate and govern the whole. The present volume, however, the sixty-ninth of the journal which in its first volume contained the statement of his theory, is only concerned with his physico-chemical work, and is the first of two volumes written in his honour by pupils and friends to signalise the completion of the fiftieth year of his age and the twenty-fifth of his theory. To it physical chemists in all parts of the world have contributed, testifying to the universal esteem in which Arrhenius and his work are held, and a fitting introduction is written by Ostwald, who relates the early history and development of the theory with many pleasant biographical and autobiographical details.

JAMES WALKER.

PROF. F. W. KOHLRAUSCH.

IT is with great regret that we have to record the death of the eminent physicist, Prof. F. W. Kohlrausch.

Kohlrausch was born in October, 1840, at Rinteln on the Weser. His father, Rudolph Kohlrausch (1809–1858), was a physicist of great distinction who, in conjunction with Wilhelm Weber, carried out for the first time a determination of the ratio of the electromagnetic to the electrostatic unit of electric quantity, and thus laid one of the corner-stones of the absolute system of electrical measurement. It was, therefore, natural that the son's attention should be early directed towards physical science. He studied at Göttingen and Erlangen, graduated Ph.D. in 1863, and in 1866 was appointed Professor Extraordinarius at Göttingen. After about a year as professor of physics at the School of Technology at Frankfort-on-the-Main, he was appointed, in 1871, to a similar post at the Grand-ducal Polytechnic at Darmstadt. In 1875 he became professor of physics in the University of Wurzburg, and was transferred thence to Strassburg in 1888. He was appointed president of the Physikalisch-Technische Reichsanstalt at Charlottenburg in 1895, and, in the same year, was elected a member of the Academy of Science of Berlin and also a Foreign Member of the Royal Society of London. He was made honorary professor of physics in the University of Berlin in 1900. He resigned his post at Charlottenburg in 1905. He was elected an honorary member of the Physical Society of London in 1906. He died at Marburg in January of this year.

Kohlrausch was the author of a great number of papers giving the results of experimental investigations in many branches of physics, but the subjects which chiefly occupied him were the methods of measuring magnetic and electrical quantities. Among his contributions to this branch of science we may mention his method for the absolute measurement of the horizontal component of the earth's magnetic field and of the strength of an electric current, by simultaneous observations of the deflection of the needle of a tangent-galvanometer and of a suspended coil where both instruments are traversed by the same current. Another important set of experiments, published in 1874, had for its object the determination of the absolute value of the "Siemens unit" of electrical resistance. The result which Kohlrausch arrived at, though